Product comprising a fibrous support and a hydrophilic and/or permeabilizing coating, preparation process therefor and use thereof

The invention relates to a product comprising a fibrous support and a hydrophilic and/or permeabilizing coating, to the process for preparing it and to its use, for example, in or for absorbent disposable products, for example in diapers.

There is a need for products comprising fibrous supports, which are often polymeric, whose hydrophilicity and/or permeability is modified, preferably durably. For example, it is sought to durably modify the hydrophilicity and/or permeability of polypropylene nonwovens included in the construction of absorbent disposable products such as baby diapers. In diapers, the polypropylene nonwoven may be the layer at least partially surrounding an absorbent compound, and in contact with the skin. In particular, it is sought to make the nonwoven durably hydrophilic and/or permeable so as not to repel urine, and so that the hydrophilicity and/or the permeability is conserved after at least one contact with urine. Furthermore, it is sought to make provision such that the surface tension of urine is not greatly lowered after it comes into contact with a compound that modifies the hydrophilicity and/or the permeability of the nonwoven.

To modify the hydrophilicity of polypropylene nonwoven, it is known practice, for example, to use surfactants, for instance polyethoxylated alkylphenols. This is described, for example, in example 1 of document WO 97/47801. Document WO 97/47801 describes products comprising a support durably coated with a hydrophilic polymer. The products are prepared by exposing the support to a plasma or corona treatment. The

hydrophilic polymer is an optionally modified polysaccharide.

However, it is still sought to propose other products and processes in order to reduce the amount of coating used and/or to improve the performance qualities of the product and/or to simplify the industrial processes, for example by proposing coatings that are simpler to implement, and/or more simply to reduce the cost price of the product.

To this end, the invention proposes a product comprising a fibrous support and a hydrophilic and/or permeabilizing coating bonded over at least part of an area of the support, characterized in that the coating comprises:

- a film covering at least part of the support,
- a hydrophilic and/or permeabilizing agent,
- optionally, a compatibilizer for the film and for at least part of an area of the support, and
- optionally, a wetting agent, other than the hydrophilic and/or permeabilizing agent.

The invention also relates to disposable absorbent products, for example baby diapers, comprising as one component thereof, the product as mentioned above or obtained using the process described below. The invention also relates to the use of the product described above or obtained using the process below, in disposable absorbent products, or for disposable absorbent products, for example in baby diapers. The product may also be used in or for wipes, for household care or for skincare, floor mops, filters, and technical papers or printing papers.

The invention also relates to a process for preparing products comprising a support and a coating on the support, which can allow the production of a product as mentioned above. The process is described below.

Definitions

The term hydrophobic polymer means a polymer that lacks water affinity. In the present patent application, a hydrophobic polymer is a polymer for which one surface has a contact angle (with water) of at least 70°.

The terms "durable bonding", "durable hydrophilization", "durable permeabilization" and "resistance to leaching" mean that a property in terms of bonding (cohesion), hydrophilicity or permeability is at least partly maintained after soaking the product twice for a few seconds (for example 5 seconds) in water or in a sodium chloride solution. A property is said to be partly maintained if at least 50%, preferably 60%, preferably at least 70%, preferably at least 80%, preferably at least 90% and preferably at least 95% of the value of a measurement attributed to said property is maintained after soaking, relative to said value before soaking.

The term "polymer" means any crosslinked or noncrosslinked macromolecular compound. In the present patent application, the term "polymer" especially covers the term "resin".

Support

The product according to the invention comprises a fibrous support and a hydrophilic and/or permeabilizing coating.

The fibrous support may be a yarn, a fiber or a filament, a woven or nonwoven textile surface, or a paper. The yarns, fibers or filaments may be yarns, fibers or filaments per se, not assembled into a textile surface. The textile surfaces may be woven or knitted surfaces, flocked textile surfaces or surfaces assembled as carpets (tufted surfaces) or nonwoven

surfaces. The fibrous support, for example a nonwoven surface, may comprise, for example, a synthetic or natural polymer, or a polymer derived from a natural polymer, for example a thermoplastic or cellulose-based polymer or a cellulose derivative, in the form of yarns, fibers or filaments. The nonwoven surfaces include surfaces made by entangling preformed fibers, and optionally subsequent calendering, hot-bonding, needlepunching, etc. treatments. The nonwoven surfaces also include nonwoven surfaces obtained using high productivity processes, generally with heat, such as "meltblown" or "spunbound" processes. All these nonwoven surfaces and all these preparation processes are known to those skilled in the art.

The polymer of the support is advantageously a hydrophobic polymer. Examples of hydrophobic polymers that may be mentioned include:

- polyolefins such as polyethylenes, polypropylenes, ethylene-propylene copolymers, polyisobutene and polyisoprene,
- polystyrenes, and copolymers comprising styrene units,
- halogenated vinyl polymers such as PVC, PTFE or PVDF,
- hydrophobic vinyl polymers,
- polyethylene terephthalates (PET).

It may also be a polymer that is not particularly hydrophobic, for instance polyamide, for example polyamide 6 or 66, or cellulose, or cellulose derivatives.

The polymer of the fibrous support may advantageously be a thermoplastic polymer based on polypropylene or polyethylene terephthalate, cellulose or a derivative, or a mixture. The support may thus be a nonwoven comprising fibers based on polypropylene, polyethylene terephthalate, cellulose or a derivative, or a mixture of these fibers (for example a nonwoven of poly-

propylene fibers or nonwoven of polypropylene fibers and of fibers of cellulose or of a derivative). These supports are particularly advantageous for products (coated supports) used in disposable absorbent products, for instance baby diapers, feminine hygiene products and comfort products for adult incontinence.

The polymer of the support may contain more or less large amounts of additives, for instance pigments, delustering agents, antioxidants, stabilizers (especially heat stabilizers, light stabilizers or UV stabilizers), paints, free-radical scavengers, catalyst residues, etc. The additives that may be present are known to those skilled in the art.

Supports that may be used are sold especially by Feudenberg (brand name Vilmed®) or BBA Nonwovens (brand name Celestra® or Veraspun®). The typical specific weights of these voile fabrics are, for example, from 10 to 20 g/m^2.

Coating

The coating is bonded to the support over at least part of an area of the support. The coating comprises:
- a film covering at least part of the support,
- a hydrophilic and/or permeabilizing agent,
- optionally, a compatibilizer for the film and for at least part of an area of the support, and
- optionally, a wetting agent, other than the hydrophilic and/or permeabilizing agent.

The film may be, for example, a polymer film. The film may be obtained from at least one film-forming agent (film-forming agent alone, or combination of film-forming agents), for example a film-forming agent that is polymeric (polymer formed before application) or nonpolymeric (but capable of forming a polymer or a

crosslinked resin after application). Details are given later.

The compatibilizers may be agents for promoting the bonding of the film to the support, or agents for promoting the attachment of film-forming agents to the support. The use and choice of such agents may depend on the nature of the support, the coating process, and the nature of the film or of the film-forming agents. Such agents are known to those skilled in the art.

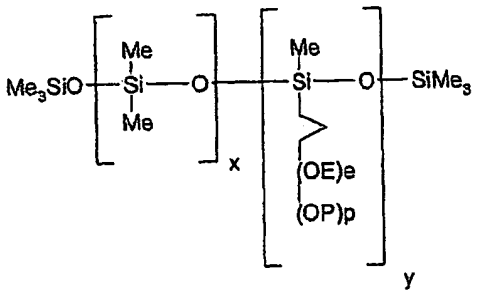
The wetting agents may be agents for promoting the bringing together of film-forming agents or of a vector comprising film-forming agents with the support. The use and choice of such agents may depend on the nature of the support, the coating process, and the nature of the film or of the film-forming agents. Such agents are known to those skilled in the art.

Hydrophilic and/or permeabilizing agent

The hydrophilic and/or permeabilizing agent may be an organic or mineral agent. It may be, for example, a mineral hydrophilic agent. In this case, the agent may be a dispersion of mineral particles included in the film, optionally in an upper part of the film, not bonded to the support (peripheral part opposite the interface between the film and the support). According to another embodiment, the agent may be a layer of mineral material covering at least part of the film.

The hydrophilic and/or permeabilizing agent may be a hydrophilic polymer, advantageously a polyether silicone.

Preferably, the polyether silicone has the formula (I) below:



(I)

the end groups of the ethylene oxides (OE) or propylene oxides (OP) being groups OR,

in which:

OE means -O-CH2-CH2-

OP means -O-CH2-CH2-CH2-

R represents a hydrogen atom or a linear or branched alkyl radical containing from 1 to 22 carbon atoms and preferably from 1 to 4 carbon atoms, or an acetyl group,

x is a number between 5 and 50,

y is a number between 3 and 10,

e is a number between 10 and 30,

p is a number between 0 and 10,

it being understood that:

x/y is less than 10 and preferably less than or equal to 8,

e+p is less than 30 and preferably less than or equal to 20,

e/p is greater than 1 and preferably greater than or equal to 4, and

x+y is less than 60 and preferably less than 40.

More preferably:

- x = 9.5, y = 3.5, e = 11.5, p = 2.5, and R represents a hydrogen atom;
- x = 14, y = 4, e = 17 and p = 1, and R represents H, a hydrogen atom; or
- x = 48, y = 6, e = 15 and p = 5, and R represents a hydrogen atom.

Polyether silicones that may be used are especially sold by Rhodia under the name Rhodorsil SP3301, or by Degussa under the name Tegopren 5843, 5851, 5857, 8404, 8450 or 8462.

Film

The film may be a polymer in the form of a film. The film may be obtained from at least one polymeric or nonpolymeric film-forming agent. It may be a film obtained from an aqueous dispersion of water-insoluble film-forming polymer (latex), for example a natural or synthetic latex.

The preferred water-insoluble film-forming polymers may be obtained by polymerization of monomers chosen from:
- vinyl esters and more particularly vinyl acetate;
- alkyl acrylates and methacrylates, the alkyl group of which contains from 1 to 10 carbon atoms, for example methyl, ethyl, n-butyl or 2-ethylhexyl acrylates and methacrylates;
- vinylaromatic monomers, in particular styrene.

These monomers may be copolymerized with each other or with other ethylenically unsaturated monomers, to form homopolymers, copolymers or terpolymers.

As nonlimiting examples of monomers that may be copolymerized with vinyl acetate and/or acrylic esters and/or styrene, mention may be made of ethylene and olefins, for instance isobutene; vinyl esters of branched or unbranched, saturated monocarboxylic acids, containing from 1 to 12 carbon atoms, for instance vinyl propionate, vinyl "Versatate" (brand name for branched C_9-C_{11} acid esters), vinyl pivalate or vinyl laurate; esters of unsaturated monocarboxylic or dicarboxylic acids containing 3 to 6 carbon atoms with alkanols containing 1 to 10 carbon atoms, for instance methyl, ethyl, butyl or ethylhexyl maleates or fumarates; vinylaromatic monomers such as

methylstyrenes or vinyltoluenes; vinyl halides such as vinyl chloride, vinylidene chloride and diolefins, particularly butadiene; (meth)allylic esters of (meth)acrylic acid, (meth)allylic esters of maleic, fumaric and itaconic acid monoesters and diesters, and also alkene derivatives of acrylic and methacrylic acid amides, such as N-methallylmaleimide.

At least two copolymerizable monomers of different nature may especially be chosen to obtain a terpolymer.

An example that may be mentioned is a terpolymer of acetate/versatate/dibutyl maleate type.

The polymerization of the latex may be performed in a manner known per se in an aqueous emulsion of the polymerizable monomers in the presence of at least one radical initiator and preferably a transfer agent, for example of the mercaptan type, with a concentration of monomers in the reaction medium generally of between 20% and 60% by weight.

The polymerization may be performed in continuous, batch or semicontinuous mode with introduction of part of the monomers continuously and may be of the "seeded" or "incremental" type according to any variant known for obtaining particles of homogeneous and heterogeneous structure.

As a nonlimiting example, for the preparation of a latex, reference will be made to the procedures described in patent EP 599 676 in the name of the present Applicant.

Acrylic polymers are preferably used for the film, i.e. polymers comprising polymers based on monomers of acrylic type (such as alkyl acrylates and methacrylates whose alkyl group contains from 1 to 10 carbon atoms, for example methyl, ethyl, n-butyl or 2-ethylhexyl

acrylates and methacrylates). These acrylic polymers may also comprise other monomers: these may be, for example, styrene-acrylic varnishes. However, in the intended applications, the "pure" acrylic coating compositions, i.e. compositions based on monomers of acrylic type alone, are even more preferred.

The latices used may be chosen such that their glass transition temperature (TG) is between 10°C and 60°C and preferably between 20°C and 40°C.

The sizes of the polymer particles in aqueous dispersion constituting the latices according to the invention may be between 300 nanometers and 20 nanometers. These particle sizes are measured by laser granulometry or by scanning microscopy after cryofracture of the sample.

Optionally, the aqueous dispersions of film-forming polymers may include plasticizers, in order to reduce the film-forming temperature (TMMF) when the process of the invention is performed under very cold temperature conditions, i.e. temperatures below 0°C.

Product characteristics

According to one embodiment, the hydrophilic and/or permeabilizing agent is included in the film. For this embodiment, it is possible, for example, to apply to the support a coating composition comprising at least one film-forming agent and the hydrophilic and/or permeabilizing agent, in a liquid vector. Without wishing to be bound to a theory, it is thought that it may be advantageous for the hydrophilic agent to migrate to the periphery of the coating (or of the film) opposite the surface of the support to which the coating is bound. It is thought that such a migration might be induced, for example, by entrainment during the removal of the vector.

According to another embodiment, the hydrophilic agent is a layer of material covering at least part of the film. For this embodiment, it is possible, for example, first to apply a composition to form the film, and then to form a layer of hydrophilic and/or permeabilizing material.

The coating, the hydrophilic and/or permeabilizing agent, the film, at least part of the surface of the support, optionally other ingredients of the coating, the amounts thereof and the preparation processes are preferably chosen such that the bonding between the support and the film is durable in the presence of an aqueous solution at a temperature of between 10°C and 50°C. This is referred to as durable coating, durable treatment, durable bonding, durable hydrophilization, resistance to leaching, or durable permeabilization.

The product is advantageously permeable to water (in particular for a nonwoven support made of polypropylene and/or cellulose or derivative, for products (coated supports) used in disposable absorbent products, for instance baby diapers, feminine hygiene products or comfort products for adult incontinence.

Furthermore, the support, the coating and their bonding are preferably such that the surface tension of an aqueous solution is not lowered by more than 50%, preferably not more than 40%, preferably not more than 30%, preferably not more than 20% and preferably 10%, after placing the product in contact with the aqueous solution.

Composition

According to one practical embodiment, the coating is obtained by applying a liquid composition, especially comprising ingredients of the coating mentioned above,

and a liquid vector (to be removed thereafter to form a film).

Thus, a composition that is useful for implementing the invention comprises:

- at least one film-forming agent in a liquid vector, forming a film after removal of the vector,
- a hydrophilic and/or permeabilizing agent,
- optionally, a compatibilizer for the film or the film-forming agent and for at least part of a surface of the support,
- optionally, a wetting agent, other than the hydrophilic and/or permeabilizing agent.

According to another embodiment, as mentioned above, the process is performed in several steps, by forming a film, preferably not comprising any hydrophilic and/or permeabilizing agent, and then by forming a layer of material covering at least part of the film.

The ingredients of the composition have been described above. The liquid vector may be an aqueous or nonaqueous vector (alcoholic, hydroxyalcoholic or other solvent), the polymer being in the form of a solution, dispersion or emulsion in this vector. Advantageously, the film-forming polymer in a liquid vector is a polymer dissolved in an aqueous vector or in a solvent, or an aqueous dispersion of film-forming polymer (latex). The nature of the vector, its amount, and any possible dilution may be determined by a person skilled in the art.

The product preferably has a weight ratio between the film and the hydrophilic and/or permeabilizing agent of between 99.9/0.1 and 90/10 and preferably between 97/3 and 95/5.

The product may have a coating (dry matter)/support weight ratio of between 1% and 25%.

Without wishing to be bound to any theory, it is thought that the film can provide sufficiently strong bonding via the simple effect of coating fibers of the fibrous support.

The presence of the film on the support may contribute toward an improvement in its mechanical properties. Thus, the products whose support is a nonwoven surface, for example comprising polypropylene and/or cellulose fibers, may have higher mechanical properties. It is also possible to reduce the density (g/m^2) of the nonwoven while at the same time maintaining satisfactory mechanical properties. For example, nonwovens with a density of less than or equal to 17 g/m^2 or even less than or equal to 15 g/m^2 may be used.

Procedure

A practical process for preparing the product according to the invention may comprise the following steps:

a) optionally, exposing at least part of the surface of the support to a preparation treatment that promotes bonding between the coating and at least the treated part of the surface of the support,

b) formation of the coating according to one of the methods b1) or b2) below:

b1)

b1a) applying to at least part of the surface of the support a coating composition comprising:

- at least one film-forming agent, for example a film-forming polymer, in a liquid vector, forming a film after removal of the vector,
- a hydrophilic and/or permeabilizing agent,

- optionally, a compatibilizer for the film or the film-forming agent and for at least part of the surface of the support,
- optionally, a wetting agent, other than the hydrophilic and/or permeabilizing agent, and then

b1b) removing the liquid vector to form a film, or

b2)

b2a) applying to at least part of the surface of the support a coating composition comprising:

- at least one film-forming agent, for example a film-forming polymer, in a liquid vector, forming a film after removal of the vector,
- optionally, a compatibilizer for the film or the film-forming agent and for at least part of the surface of the support,
- optionally, a wetting agent, other than the hydrophilic and/or permeabilizing agent, and then

b2b) removing at least part of the vector to form a film, and then

b2c) forming a layer of hydrophilic and/or permeabilizing mineral material covering at least part of the film.

If the film-forming agent used is a film-forming polymer, it may be a polymer dissolved in an aqueous vector or in a solvent, or may be an aqueous dispersion of film-forming polymer (latex).

Step a) is an optional pretreatment step. Such a step may be intended to improve the affinity of the composition for at least the part of the support intended to be coated, and/or to improve the bonding between the coating and at least the treated part of the surface of the support. This treatment may be a

dry-route or wet-route treatment. Examples that are mentioned among the dry-route treatments include treatments of corona, UV irradiation or plasma type. Such surface treatments are known to those skilled in the art. Examples of wet-route treatments include treatments of chemical type, for example using chemical compounds that modify the chemical functions present at the surface of the support (oxidations, degradations, reductions, etc.).

Step b1a) or b2a) may be performed via any process for applying a liquid composition to a support. Any impregnation, covering or coating technique may be used. The process may be performed, for example, by

- spraying onto at least part of a surface of the support,
- introduction of at least part of a surface of the support into a bath of composition,
- application of the composition using devices such as doctorblades, brushes or rolls.

Industrial processes for applying compositions are especially known under the following names: "kiss roll", "foaming".

Step b1b) or b2c) of removal may be performed via simple evaporation, optionally accelerated by heating, or any other means (infrared, etc.).

According to one practical embodiment in the context of products whose support is a textile surface (for example a nonwoven surface that may be used in disposable absorbent products), the support is in motion during the implementation of step b). The support is, for example, in traveling motion of a surface:

- which is unrolled and then rolled up (specific treatment step),

- formed (manufacture of the surface) and then rolled up (treatment downstream of the manufacture of the textile surface),
- unrolled and then assembled with other components after treatment (treatment upstream of the assembly or of the construction of a product such as a disposable absorbent product) or
- formed (manufacture of the surface), treated and then assembled with other components after treatment (integration of the upstream steps of manufacture of the textile surface and downstream steps of assembly or construction of a product such as a disposable absorbent product).

Products according to the invention and uses

According to one embodiment of the invention, the support is a nonwoven surface, for example a nonwoven surface based on polypropylene or polyethylene terephthalate. The product according to the invention included in (or used in) a disposable absorbent product, preferably a baby diaper (nappy), a feminine hygiene product, or a comfort product for adult incontinence. Such products are known to those skilled in the art. They generally comprise an absorbent compound, in an envelope comprising a permeable inner layer intended to come into contact with the user's skin, and an outer layer, which is generally impermeable. The product according to the invention is preferably used as inner layer, in the construction of disposable absorbent products. It is pointed out that the disposable absorbent product may comprise other components, known to those skilled in the art, for example elastics, distribution of voile fabrics, etc.

In this respect, the product may be in the form of a semifinished intermediate product used for the construction or assembly of a disposable absorbent product, preferably a baby diaper (nappy), a feminine

hygiene product, or a comfort product for adult incontinence. It may then be in the form of rolls, and may be marketed by manufacturers of nonwoven surfaces. The treatment is then preferably performed downstream of the manufacture of nonwoven surfaces.

The product may also be in the form of part of a disposable absorbent product, preferably a baby diaper (nappy), a feminine hygiene product, or a comfort product for adult incontinence, and may be marketed by manufacturers of finished consumer products. The treatment will have been performed as mentioned above, or in continuous mode upstream of the manufacture of the finished articles (assembly or construction of diapers), from rolls of untreated nonwoven surfaces, or in integrated processes of manufacture of surfaces, treatment and assembly.

Other details or advantages of the invention will become apparent in the light of the examples below without any limiting nature.

EXAMPLES

The following products are used for the implementation of the examples:

Reference	Product	Type
SP1	Rhodorsil SP3301, Rhodia	Hydrophilic agent
SP2	Tegopren 5851, Degussa	Hydrophilic agent
Latex 1	Rhodopas D2040, Rhodia (aqueous dispersion of an acrylic latex containing 48% by weight of solid)	Film-forming polymer
Nonwoven	Sample of nonwoven of hot-melt bonded polypropylene fibers of about 17 g/m^2 of 6 × 6 cm^2	Support

Compositions are prepared by addition of the hydrophilic agents to latex 1, at room temperature, with the latex/agent ratios mentioned in table I below, expressed on a dry matter/dry matter basis, and dilution with deionized water.

Preparation of products comprising a support and a coating

The process is performed as follows:
- spraying of the composition onto the support diluted up to 50-fold in deionized water,
- drying to remove the water and to create the film,
- quantification of the amount of coating by weighing (before and after spraying and drying). This amount is indicated in table I.

Table I

Sample	Hydrophilic agent, content	Dilution	Amount of coating (%)
1	SP 1, 96/4	10	16.5
2	SP 1, 95/5	10	16.5
3	SP 1, 94/6	10	16.5
4	SP 1, 93/7	10	16.5
5	SP 1, 95/5	20	9.25
6	SP 1, 95/5	50	2.5
7	SP 2, 95/5	10	16.5
8	SP 2, 95/5	20	9.25
9	No coating (support controls)		

Product evaluation

Test 1: Qualitative hydrophilicity/permeability

5 ml of saline water ([NaCl]=9 g/l) are passed through a sample placed on three sheets of absorbent paper. The behavior of the water on the sample is observed visually.

Test 2: Quantitative hydrophilicity/permeability

By working as described in standard Edana ERT 150 (strike through), the time of passage (seconds) of 5 ml of saline water ([NaCl]=9 g/l) through samples (disk 32 mm in diameter) is measured using two electrodes. The experiment is repeated five times consecutively (5 passages), at 60-second intervals.

Test 3: Surface tension of a washing water (with NaCl)

The process is performed as described in standard ASTM D1331, on a sample of 6 x 6 cm, by immersing the sample in 40 ml of saline water ([NaCl]=9 g/l), stirring with a spatula for 5 seconds, leaving to stand for 5 minutes, stirring for 10 seconds and removing the sample. The surface tension is measured with a Whilemy plate according to ASTM standard D1331. The tests are performed at 24°C using as reference distilled water at 71.9 mN/m^2 and a saline solution measured at 71 mN/m^2.

Table II: Evaluation results

Sample	1	2	3	4	5	6	7	8	9
Test 1*	OK	OK	OK	OK	OK	OK	OK	OK	No
Test 2 (1st passage, seconds)	18-20	3-4	2-3	2-3	6-8	>60	9-10	4-13	/
Test 2 (5th passage, seconds)	8-9	2-3	2-3	1.5-2	3-4	5-8	6-9	4-7	/
Test 3 (mN/m)	66.4	53	47.5	49.2	60.5	63	51.4	54.2	/

*OK = permeable/No = impermeable

It is seen that the invention provides advantageous, durable hydrophilicity and/or permeability, without substantially lowering the surface tension of a washing water.